

TFF1018HN

Integrated mixer oscillator PLL for satellite LNB

Rev. 2 — 7 December 2011

Product data sheet

1. General description

The TFF1018HN/N1 is an integrated downconverter for use in Low Noise Block (LNB) converters in a 10.7 GHz to 12.75 GHz K_u band satellite receiver system.

2. Features and benefits

- Low current consumption integrated pre-amplifier, mixer, buffer amplifier and PLL synthesizer
- Flat gain over frequency
- Single 5 V supply pin
- Low cost 25 MHz crystal
- Crystal controlled LO frequency generation
- Switched LO frequency (9.75 GHz and 10.6 GHz)
- Low phase noise
- Low spurious
- Low external component count
- Alignment-free concept
- ESD protection on all pins

3. Applications

- K_u band LNB converters for digital satellite reception (DVB-S / DVB-S2)

4. Quick reference data

Table 1. Quick reference data

$V_{CC} = 5\text{ V}$; $T_{amb} = 25\text{ °C}$; $f_{LO} = 9.75\text{ GHz}$ or 10.6 GHz ; $f_{xtal} = 25\text{ MHz}$; $Z_0 = 50\text{ }\Omega$ unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------|------------------------------|--|------|-----|-------|------|
| V_{CC} | supply voltage | | 4.5 | 5 | 5.5 | V |
| I_{CC} | supply current | RF input and IF output AC coupled | - | 52 | - | mA |
| NF_{SSB} | single sideband noise figure | measured at low band $f_{IF} = 1450\text{ MHz}$ and high band $f_{IF} = 1625\text{ MHz}$ | - | 7 | - | dB |
| $f_{i(RF)}$ | RF input frequency | low band | 10.7 | - | 11.7 | GHz |
| | | high band | 11.7 | - | 12.75 | GHz |
| G_{conv} | conversion gain | measured at low band $f_{IF} = 1450\text{ MHz}$ and high band $f_{IF} = 1625\text{ MHz}$ | - | 45 | - | dB |



Table 1. Quick reference data ...continued

$V_{CC} = 5\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $f_{LO} = 9.75\text{ GHz}$ or 10.6 GHz ; $f_{xtal} = 25\text{ MHz}$; $Z_0 = 50\text{ }\Omega$ unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------|------------------------------------|--|-----|-----|-----|------|
| S_{11} | input reflection coefficient | $f_{RF} = 10.7\text{ GHz}$ to 12.7 GHz | - | -10 | - | dB |
| S_{22} | output reflection coefficient | $f_{IF_OUT} = 950\text{ MHz}$ to 2150 MHz ; $Z_0 = 75\text{ }\Omega$ | - | -10 | - | dB |
| $IP3O$ | output third-order intercept point | carrier power is -10 dBm (measured at output) | - | 15 | - | dBm |

5. Ordering information

Table 2. Ordering information

| Type number | Package | | Version |
|--------------|----------|---|----------|
| | Name | Description | |
| TFF1018HN/N1 | DHVQFN16 | plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body $2.5 \times 3.5 \times 0.85\text{ mm}$ | SOT763-1 |

6. Block diagram

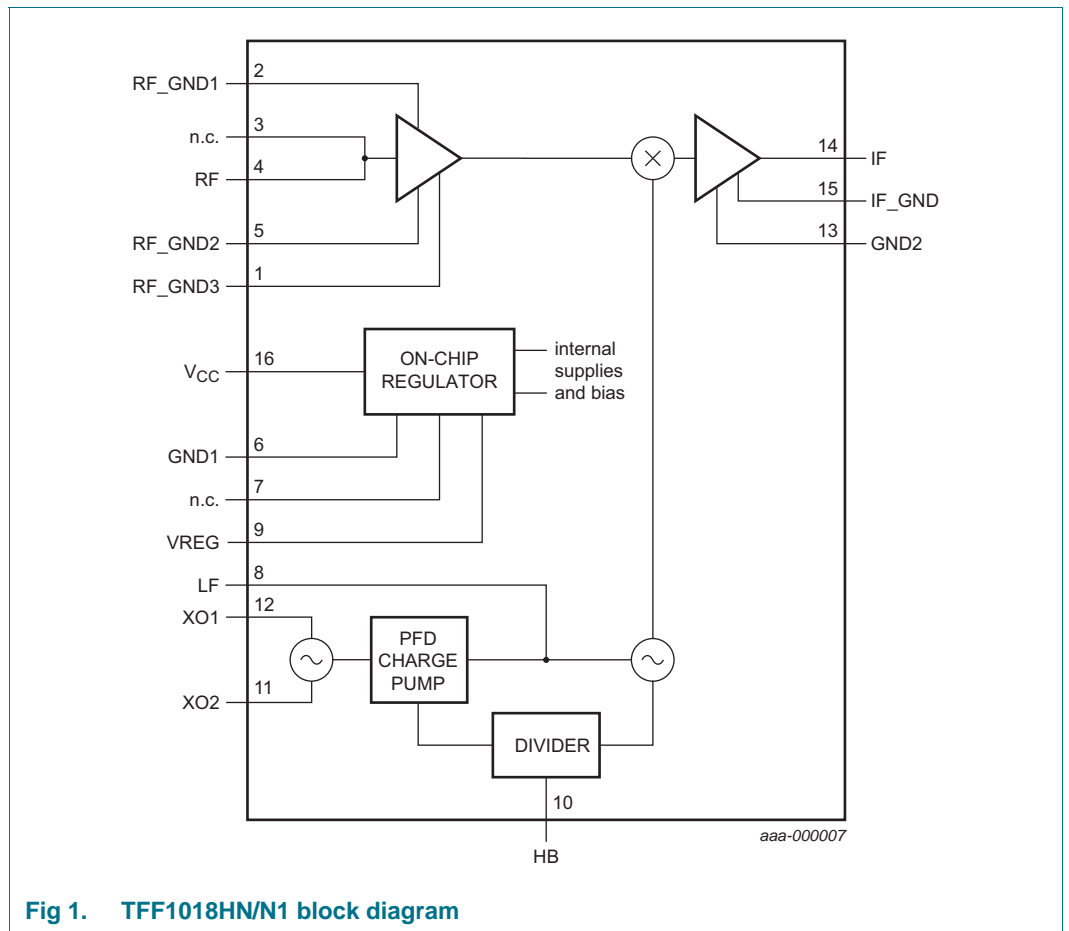
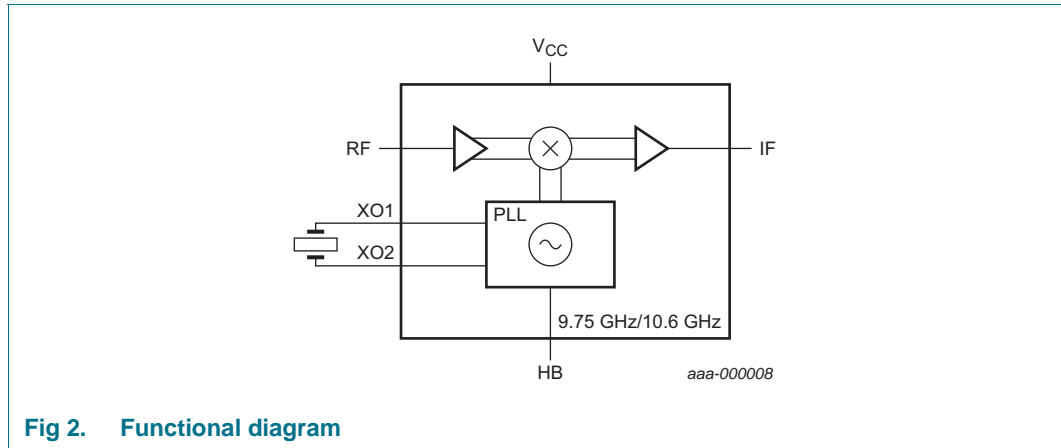


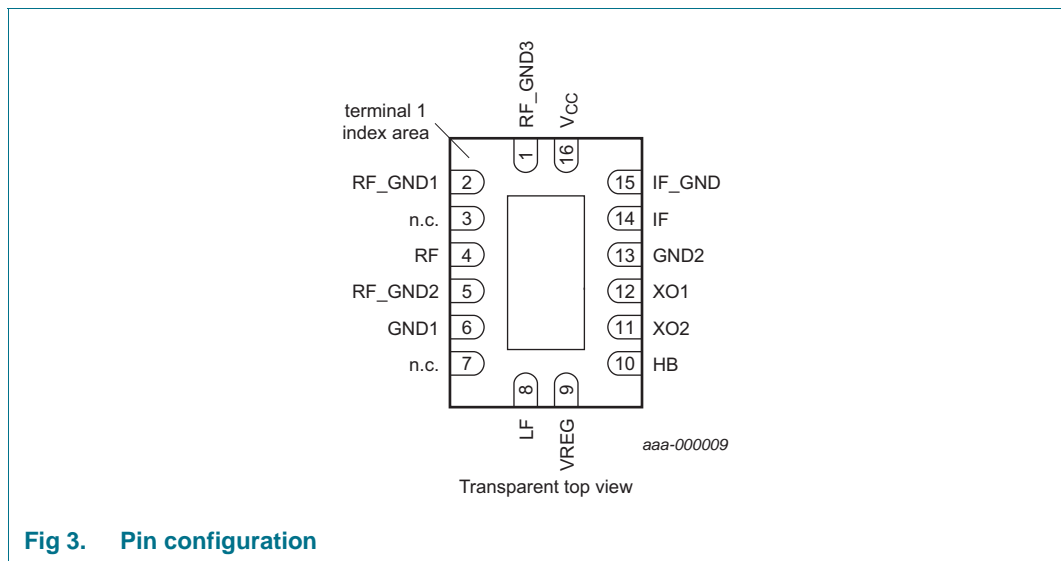
Fig 1. TFF1018HN/N1 block diagram

7. Functional diagram



8. Pinning information

8.1 Pinning



8.2 Pin description

Table 3. Pin description

| Symbol | Pin | Description |
|---------|-----|---|
| GND | 0 | ground (exposed die pad) |
| RF_GND3 | 1 | RF ground. Connect this pin to the exposed die pad landing. |
| RF_GND1 | 2 | RF ground. Connect this pin to the exposed die pad landing and the RF input CPW line. |
| n.c. | 3 | not connected. Connect to RF on PCB. [1] |
| RF | 4 | RF input. |
| RF_GND2 | 5 | RF ground. Connect this pin to the exposed die pad landing and the RF input CPW line. |

Table 3. Pin description ...continued

| Symbol | Pin | Description |
|-----------------|-----|--|
| GND1 | 6 | Ground. Connect this pin to the exposed die pad landing and the RF input CPW line. |
| n.c. | 7 | not connected. Use this pin to route the ground layer on top of the PCB to the exposed die pad. |
| LF | 8 | Loop filter PLL. Connect loop filter between this pin and VREG (pin 9). |
| VREG | 9 | Regulated output voltage for VCO loop filter. Connect loop filter to this pin. Decouple against die pad via pin 7. |
| HB | 10 | High band / low band selection. Connect this pin to the tone detector or to a logic signal. |
| XO2 | 11 | Crystal connection 2. Connect crystal between this pin and XO1 (pin 12). |
| XO1 | 12 | Crystal connection 1. Connect crystal between this pin and XO2 (pin 11). |
| GND2 | 13 | Ground. Connect this pin to the exposed die pad landing. |
| IF | 14 | IF output |
| IF_GND | 15 | IF output ground. Connect this pin to the exposed die pad landing and the output transmission line ground. |
| V _{CC} | 16 | Supply voltage |

[1] The distance between the outer edges of pin 2 and pin 3 is 740 μm . This gives an optimum transition from a 1.1 mm wide, $Z_0 = 50 \Omega$ line on RO4223 Printed-Circuit Board (PCB) material of 0.5 mm height to the TFF1018HN/N1.

9. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Min | Max | Unit |
|--------------------|-------------------------|------------|------|------|------|
| V _{CC} | supply voltage | | -0.5 | +6 | V |
| V _{I(HB)} | input voltage on pin HB | | -0.5 | +6 | V |
| T _{stg} | storage temperature | | -40 | +125 | °C |

10. Recommended operating conditions

Table 5. Operating conditions

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------------|------------------------------|------------|------|------|-------|----------|
| V _{CC} | supply voltage | | 4.5 | 5 | 5.5 | V |
| V _{I(HB)} | input voltage on pin HB | | 0 | - | 5.5 | V |
| T _{amb} | ambient temperature | | -40 | +25 | +85 | °C |
| Z ₀ | characteristic impedance | | - | 50 | - | Ω |
| f _{i(RF)} | RF input frequency | low band | 10.7 | - | 11.7 | GHz |
| | | high band | 11.7 | - | 12.75 | GHz |
| f _{LO} | LO frequency | low band | - | 9.75 | - | GHz |
| | | high band | [1] | 10.6 | - | GHz |
| f _{o(IF)} | IF output frequency | low band | 0.95 | - | 1.95 | GHz |
| | | high band | 1.1 | - | 2.15 | GHz |
| C _{L(xtal)} | crystal load capacitance | | - | 10 | - | pF |
| ESR | equivalent series resistance | | - | - | 40 | Ω |
| f _{xtal} | crystal frequency | | - | 25 | - | MHz |

[1] For a 10.75 GHz LO frequency, select high band and use a crystal with frequency $10.75 \text{ GHz} / 424 = 25.353774 \text{ MHz}$.

11. Thermal characteristics

Table 6. Thermal characteristics

| Symbol | Parameter | Conditions | Typ | Unit |
|---------------|--|------------|-----|------|
| $R_{th(j-c)}$ | thermal resistance from junction to case | | 35 | K/W |

12. Characteristics

Table 7. Characteristics

$V_{CC} = 5\text{ V}$; $T_{amb} = 25\text{ °C}$; $f_{LO} = 9.75\text{ GHz}$ or 10.6 GHz ; $f_{xtal} = 25\text{ MHz}$; $Z_0 = 50\ \Omega$ unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------------------|--|---|-----|-----|-----|------------|
| I_{CC} | supply current | RF input and IF output AC coupled | - | 52 | - | mA |
| $\Phi_{n\lambda(itg)RMS}$ | RMS integrated phase noise density | integration offset frequency = 10 kHz to 13 MHz; loop bandwidth = crossover bandwidth | - | 1.5 | - | deg |
| NF_{SSB} | single sideband noise figure | measured at low band $f_{IF} = 1450\text{ MHz}$ and high band $f_{IF} = 1625\text{ MHz}$ | - | 7 | - | dB |
| G_{conv} | conversion gain | measured at low band $f_{IF} = 1450\text{ MHz}$ and high band $f_{IF} = 1625\text{ MHz}$ | - | 45 | - | dB |
| ΔG_{conv} | conversion gain variation | over whole IF band | - | 0.7 | - | dB |
| | | in every 36 MHz band | - | 0.3 | - | dB |
| S_{11} | input reflection coefficient | $f_{RF} = 10.7\text{ GHz}$ to 12.7 GHz | - | -10 | - | dB |
| S_{22} | output reflection coefficient | $f_{IF_OUT} = 950\text{ MHz}$ to 2150 MHz ; $Z_0 = 75\ \Omega$ | - | -10 | - | dB |
| $IP3O$ | output third-order intercept point | carrier power is -10 dBm (measured at the output) | - | 15 | - | dBm |
| $P_{L(1dB)}$ | output power at 1 dB gain compression | | - | 6 | - | dBm |
| $V_{IL(HB)}$ | low level input voltage on pin HB | | - | - | 0.8 | V |
| $V_{IH(HB)}$ | high level input voltage on pin HB | | 2.0 | - | - | V |
| $R_{pd(HB)}$ | pull down resistance on pin HB | | 80 | 110 | 140 | k Ω |

13. Application information

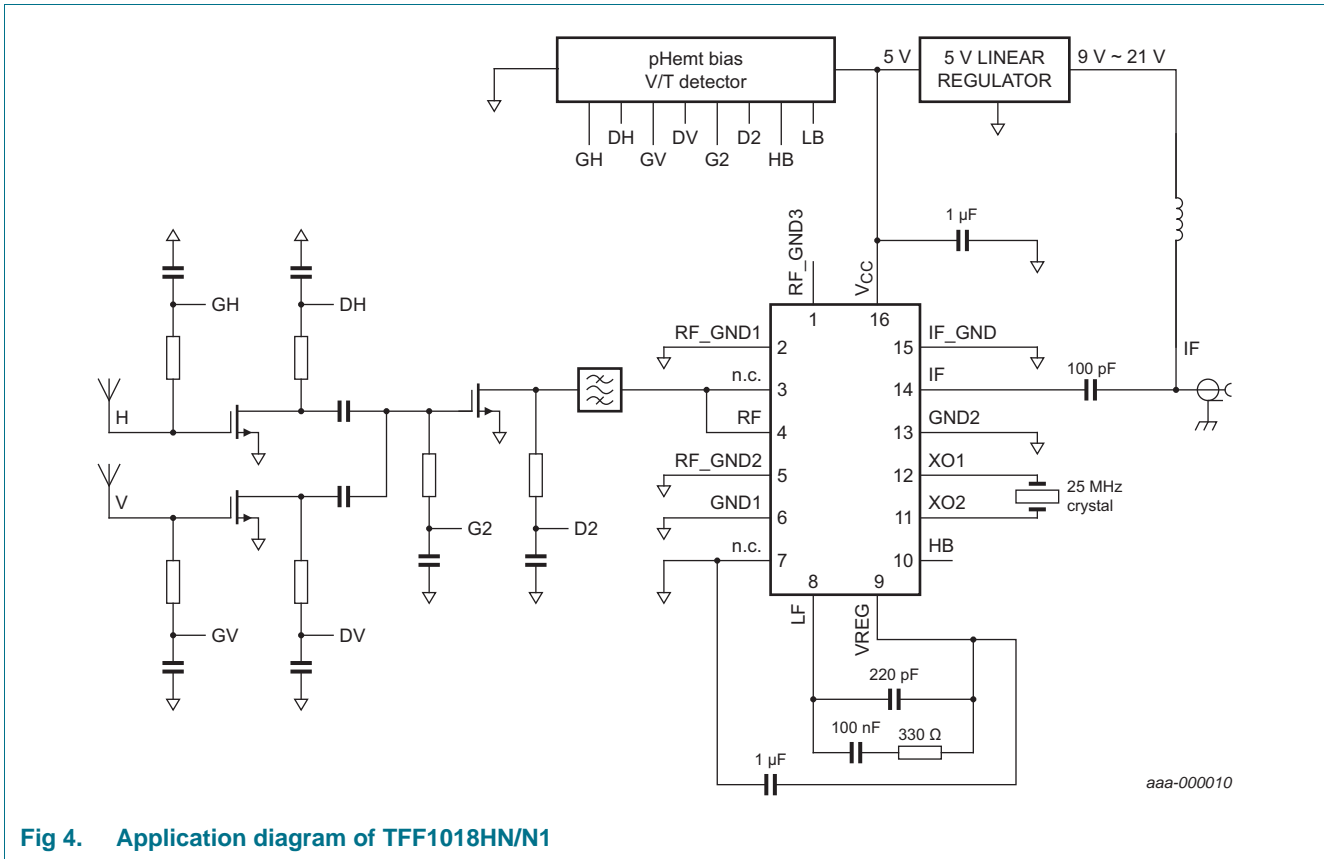


Fig 4. Application diagram of TFF1018HN/N1

Table 8. List of netnames

See [Figure 4](#).

| Netname | Description |
|---------|---|
| GH | Gate voltage of 1st stage LNA. Horizontal polarization |
| DH | Drain voltage of 1st stage LNA. Horizontal polarization |
| GV | Gate voltage of 1st stage LNA. Vertical polarization |
| DV | Drain voltage of 1st stage LNA. Vertical polarization |
| G2 | Gate voltage of 2nd stage LNA |
| D2 | Drain voltage of 2nd stage LNA |
| HB | High band oscillator supply control |
| LB | Low band oscillator supply control |

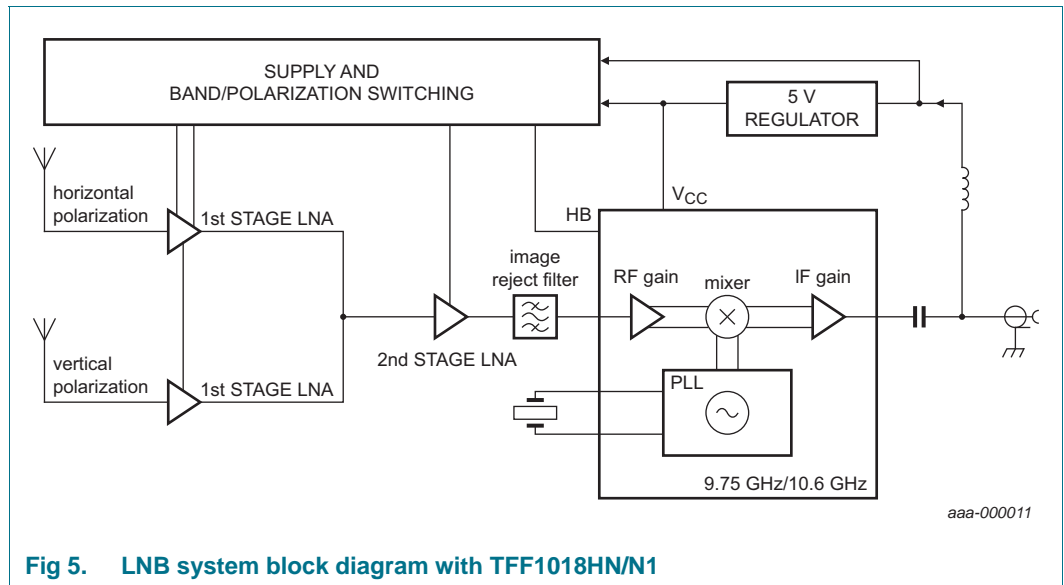


Fig 5. LNB system block diagram with TFF1018HN/N1

14. Package outline

DHVQFN16: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 x 3.5 x 0.85 mm

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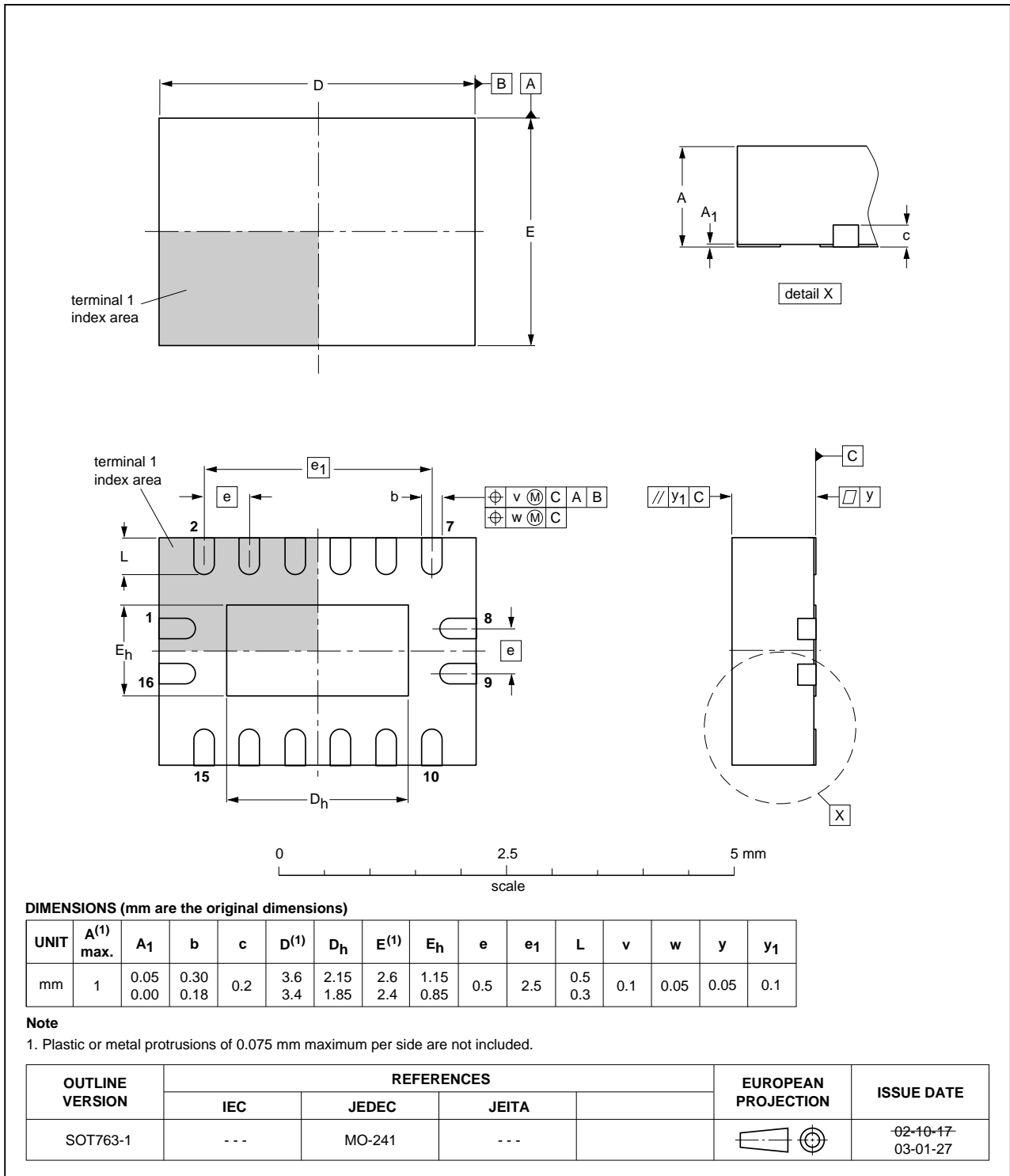


Fig 6. Package outline SOT763-1

15. Abbreviations

Table 9. Abbreviations

| Acronym | Description |
|---------------------|--|
| CPW | CoPlanar Waveguide |
| DVB-S | Digital Video Broadcasting by Satellite |
| DVB-S2 | Digital Video Broadcasting - Satellite - Second generation |
| ESD | ElectroStatic Discharge |
| IF | Intermediate Frequency |
| K _u band | K-under band |
| LO | Local Oscillator |
| PFD | Phase Frequency Detector |
| pHemt | pseudomorphic High electron mobility transistor |
| PLL | Phase-Locked Loop |
| RF | Radio Frequency |
| VCO | Voltage-Controlled Oscillator |
| V/T | Voltage / Tone |

16. Revision history

Table 10. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|------------------|--|----------------------|---------------|------------------|
| TFF1018HN v.2 | 20111207 | Product data sheet | - | TFF1018HN_N1 v.1 |
| Modifications: | <ul style="list-style-type: none"> The status of this data sheet has been changed to Product data sheet | | | |
| TFF1018HN_N1 v.1 | 20110912 | Objective data sheet | - | - |

17. Legal information

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|-----------------------------------|-------------------------------|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
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| Product [short] data sheet | Production | This document contains the product specification. |

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[2] The term 'short data sheet' is explained in section "Definitions".

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